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Evaluation

March 27, 1973
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BIOLOGICAL EVALUATION

JULIAN-CUYAMACA ZONE OF INFESTATION
LAGUNA MOUNTAIN PROJECT
CLEVELAND NATIONAL FOREST
SAN DIEGO COUNTY

By

Ken Swain [1/], Dick Hunt [2/], and Max Ollieu [1/]

INTRODUCTION

A biological evaluation of the bark beetle buildup in the Laguna Mountains was made by Forest Service and California Division of Forestry entomologists during the week of March 5, 1973. Private and Federal lands were examined and biological data collected for the evaluation.

The maintenance insect control program offers a means to suppress bark beetle populations, decrease tree mortality, and therefore provide some degree of protection to pine stands in high-use recreation areas and adjacent timberlands. The new cooperative insect control project, which was initiated in 1973, will enable all the private lands to be treated, hence, strengthening the total Laguna Mountain insect control project.

BACKGROUND

Bark beetle control first began on Laguna Mountain in 1929 and continued intermittently until 1952. During this period, most of the effort was aimed at controlling the western pine beetle in Coulter pine. In 1952, a maintenance control program was initiated against the western pine beetle and was expanded in 1957 to include the California flatheaded borer in Jeffrey pine. The control program has been approved annually by the California Forest Pest Control Action Council.

1/ Forest Entomologist, U. S. Forest Service, Regional Office, San Francisco, California 94111.

2/ Forest Entomologist, California Division of Forestry, State Forester's Office, Sacramento, California 95814.

Forest Service crews have treated an average of 680 trees per year since 1962 on National Forest land. Additionally, since 1967 the Forest Service has treated an average of 53 trees per year on a small portion of private land. Control efforts on National Forest and private land are shown in the following table:

TREES TREATED IN LAGUNA MOUNTAINS

Fiscal Year	Forest Service	Private	Total
1962	974	-	974
1963	666	62	728
1964	375	?	375
1965	400	?	400
1966	574	?	574
1967	468	128	596
1968	315	19	334
1969	822	98	920
1970	779	28	807
1971	820	0	820
1972	1292	44	1336
GRAND TOTAL	7485	379	7864

CAUSAL AGENT

The primary insects are the California flatheaded borer, Melanophila californica, in Jeffrey pine, and the western pine beetle, Dendroctonus brevicomis, in Coulter pine. The pine engraver beetles, Ips spp., and red turpentine beetle, Dendroctonus valens, will attack both pine species, but under most conditions are considered secondary insects. In southern California Forests, the California flatheaded borer is an aggressive tree killer.

HOST TREES

The major tree species is Jeffrey pine (Pinus jeffreyi). It occurs in pure stands of all age classes with occasional mixture of black oak and incense-cedar. The fringe areas support a stand of Coulter pine (Pinus coulteri).

LOCATION AND EXTENT OF INFESTATION

The infestation extends throughout the timbered portions of the Laguna Mountains, Descanso District, Cleveland National Forest in San Diego County (Figs. 1 and 2). There are approximately 7,200 timbered acres on National Forest land and 2,150 timbered acres of private land in the bark beetle maintenance control project for a total of 9,350 acres.

The District has on file a long-range insect control plan which delineates the infestation areas on Federal lands into treatment intensity classes and work priorities in accordance with R-5 Emergency Directive No 1, FSM 5242. Private timberlands within the Julian-Cuyamaca Zone of Infestation have also been delineated into intensity classes and work priorities in order to coordinate control activities. Intensity is broken into four classes, with Class I designated to receive continuous treatment and Class II to receive seasonal treatment. Work priorities are categories A (1st priority), B (2nd priority), and C (3rd priority), and only apply to intensity Classes I and II. There are 680 acres in Classes III and IV which are low-use areas that require separate evaluations before control work can be approved for funding.

Acreage figures for Federal and private timberland by work priorities are shown below for intensity Classes I and II.

Acreage of Federal and Private Timberlands by Work Priority

Work Priority	Federal	Private	Total
A	2,700	740	3,440
B	2,820	700	3,520
C	1,000	710	1,710
Total -	6,520	2,150	8,670

TYPE OF DAMAGE

Chronic bark beetle caused tree mortality has been and continues to be a major problem in the Laguna Mountains. These trends change in response to both favorable and adverse environmental factors. Some of the adverse impacts of tree mortality on this recreation forest are: (1) reduced esthetic values, (2) increased hazard to persons and property, (3) increased fire hazard, and (4) monetary loss through: (a) fewer visits, (b) reduced property values, (c) insect control treatments, and (d) dead tree removal.

ENVIRONMENTAL AND OTHER FACTORS

Current knowledge indicates that adverse environmental factors that injure trees or cause stress, reduce the tree's resistance to bark beetle attack. Some of the factors significantly influencing the current bark beetle population trends are moisture, site, plant pathogens, fire and recreation.

Moisture. Periodic drought conditions favor insect outbreaks by putting serious moisture stress on timber stands. Average rainfall is 25 inches in the Laguna Mountains, which makes pine production marginal for this particular latitude and elevation. Precipitation from July 1, 1972 to March 5, 1973 totalled 17.33 inches, while only 10.78 inches of precipitation (44% of normal) fell in 1971. Sixty percent of normal rainfall fell in 1969 and 1970.

Site. Site classes are marginal for timber growth in the Lagunas with site class IV and lower common. Competition for moisture quickly becomes critical in overstocked portions of the stand. Brush removal in certain instances through fire, chemical or mechanical methods reduces the demand for available moisture and enhances the natural defense mechanisms of the trees to resist beetle attack. The timber stand is in a high risk condition and competition should be reduced to allow the trees to successfully compete for moisture.

Plant Pathogens. Jeffrey pine in the Laguna Mountains has been weakened by diseases over a number of years. Periodically, root rots, Armillaria mellea, and particularly Fomes annosus, have weakened or killed many trees. However, a more serious problem is the effect of dwarf mistletoe, Arceuthobium campylopodum. This parasite has killed many small trees and weakened larger trees to the point where they are attacked and killed by the California flatheaded borer. In a 1957 report Trostle said, "There was a close parallel between the proportion infested by flatheads and by mistletoe. In the smaller diameter classes the proportion was somewhat more than 50 percent with the percentage rising to 100 for both organisms in the larger diameter classes. This suggests that mistletoe and flatheaded borers in combination are the primary cause of the damage ... Only about one-third of the trees in each diameter class contained both flatheads and heavy or medium mistletoe infections. Another third contained flatheads but no evidence of mistletoe or only light infections. The remaining one-third had medium to heavy mistletoe infections only." 1/

Fire Damage. Historically, fire has played its role in influencing the vegetational composition found in the Laguna Mountains. The most recent fire burned 80 acres of Jeffrey pine, July 2, 1972, near Camp Ole. The fire was extremely hot and most of the Jeffrey pine were severely burned or had cooked cambium around the root collar. The intensity of the fire and the hot summer weather had the effect of rapidly drying the cambium. Secondary borers also attacked many of the trees, consequently, most of the trees were unsuitable for primary bark beetle attack.

1/ Trostle, Galen C. Forest Insect Conditions Report. Mt. Laguna Recreation Area, Cleveland N.F., Appraisal Survey, October 1957. Calif. Forest & Range Expt. Station, Berkeley, California.

The Laguna Fire of September 1970 burned 1,000 acres of timberland and another 174,400 acres of brush and grasslands. Logging and fuelwood cuts plus some burying of logs helped remove the trees killed or damaged but some are still available for insect attack. Generally, the residual stand in the burn is increasing in vigor because the fire removed the trees and vegetation which compete for moisture.

Recreation Use. The Laguna Mountains offer the closest conifer forest type available to the 1.4 million San Diego residents. Six large campgrounds, and three picnic sites are available with more recreation areas planned and under development on both private and Federal land. The continuous abuse of the trees and soil compaction is causing adverse stress on the trees in these high-use areas.

BIOLOGICAL INFORMATION

An estimated 6,000 dead and dying pines are infested with California flatheaded borer, pine engraver beetles and western pine beetles on the 9,350 acres of private and National Forest timberland in the Laguna Mountains. California flatheaded borer has been the main insect responsible for the majority of pine mortality with pine engraver beetle important but less so, and western pine beetle a minor factor in Coulter pine mortality. Larvae and prepupae of the California flatheaded borer were found as well as parent adults and early instar larvae of the western pine beetle.

Bark samples with evidence of borer feeding were collected at breast height and on opposite sides of the tree from nine trees at four locations. These samples were X-rayed in the laboratory and the X-rays were developed and interpreted to determine beetle stage and numbers. Radiographs showed borers in the larval and prepupal stages with an average of 18 larvae per square foot. Number of borers per square foot ranged from zero to 50. Only one predator larva was detected in the 18 samples. Woodpecker predation varied from light to heavy on the trees observed, which only represented a small sample.

DISCUSSION

The pine stand on the Laguna Mountains is currently being severely attacked by California flatheaded borer. Other bark beetles causing mortality are the pine engraver beetle and western pine beetle. Unfortunately, inclement weather precluded obtaining a large bark sample of California flatheaded borer. In X-ray samples, an average of 18 larvae per square foot were found and there are an estimated 6,000 infested trees. In 1968, X-rayed bark samples had an average of 15 larvae per square foot and only 596 trees were treated, which represented most of the infested trees. In the current infestation, very little predator or parasite activity was observed. Consequently, from the sample obtained it appears the California flatheaded borer population is increasing.

The timber stand in the Laguna Mountains is rapidly deteriorating in health and vigor. The past three years of below-normal rainfall and the impact of dwarf mistletoe and other pathogens on Jeffrey pine is such that in many areas individual trees can no longer successfully compete with their neighbors. In order to increase the health and vigor of the stand, it is necessary to reduce the stand stocking to a level which will allow the residual stand to compete successfully for available moisture. The best way to attain stocking reduction of merchantable timber is to initiate a selection harvest of the high risk trees. Some additional follow-up silvicultural treatment (thinning, dwarf mistletoe control) may be necessary in overstocked stands of unmerchantable trees.

The magnitude of the current infestation indicates that it is necessary to use all suppression methods available in order to effectively suppress the infestation. Salvage logging and fuelwood sales offer the best alternative for suppression of infested timber through removal of the infested material from the forest environment.

In the past it has been difficult to make timber sales (green or salvage) because of the 150-mile haul to the nearest large capacity mill -- Big Bear Timber Company in Redlands. Current conditions favoring the sale are: (1) the record high prices for lumber, (2) the lack of inventory at the mill (presently the mill is closed because snow has stopped logging operation elsewhere and the mill log decks are bare), (3) the general lack of proposed timber sales in southern California, (4) an estimated large volume of infested logs about 3/4 MMBF on all ownerships, and (5) a substantial green volume (to be estimated later) of high risk trees. There is also an estimated 2 MMBF of green timber to be sold from two fuel modification projects.

Fuelwood sales can provide an outlet for unmerchantable infested material when that material is moved several miles from the Forest. Therefore, professional wood cutters and San Diego residents with wood storage areas away from the Jeffrey pine type can be utilized.

The chemical treatment of infested trees in high-use areas not conducive to logging or wood sales should continue concurrently. Federal and State crews should coordinate their activities on contiguous, high-use areas.

A dwarf mistletoe control program has been in progress in the Laguna Mountains for a number of years. This program should be continued along with other silvicultural measures to help increase stand vigor. Additionally, the relationship between root rot, dwarf mistletoe infection and California flatheaded borer attacks on Jeffrey pine is not fully understood and needs to be studied.

It was previously recommended that a cooperative insect control project on private land be established as soon as possible to support the control work being done by the Forest Service. This control project has now been started by the California Division of Forestry. Consequently, the entire insect control project has been strengthened considerably.

The California flatheaded borer is not normally considered to be an important tree killer, but it has unique status in southern California as a primary pest. Unfortunately, the reasons for this are not understood. Therefore, it would be desirable to have a study on the population dynamics of the California flatheaded borer in southern California. When such information becomes available, better timber management decisions can be made for protecting the stand from this insect.

RECOMMENDATIONS

The practice of evaluating bark beetle infestations has not yet developed into an exact science. Although improved tools and methods are under development for evaluation, these are not yet available, and as in the past, the need for suppression is judged primarily on the basis of tree mortality and the environmental factors affecting the area.

Four recommendations are made to help control the chronic infestation in the Laguna Mountains.

1. Continue the maintenance control program on both National Forest and private land.

   Considering the high recreation and property values at stake; recognizing that increasingly unfavorable environmental factors of drought, air pollution damage and fire damage will probably cause increased bark beetle damage; this is the best method available to attain minimal loss levels in recreation and urbanized forests. Maintenance control includes the following practices which should be given consideration in the following order of priority:

   (1) Selection cutting should be initiated on National Forest land and private land.

   (2) Silvicultural treatment in overstocked stands should be continued and/or initiated on all ownerships.

   (3) When possible, removal of insect-infested trees should be accomplished by salvage logging or wood cutters. Be certain infested material is removed from the forest environment.

   (4) When necessary, infested trees can be treated with a 1.5% lindane spray. Application instructions are found in R5 FSM 5240, Emergency Directive No. 1, dated May 3, 1968. Lindane applied in accordance with these instructions will have minimal adverse effects on human health, wildlife, fish or domestic animals.

2. Continue the evaluation and control program on dwarf mistletoe in order to increase individual tree and stand vigor.

3. A study should be initiated on the population dynamics of the California flatheaded borer in southern California (R.O. responsibility).

4. A study should be initiated to determine the interrelationship and effect of dwarf mistletoe and root diseases on the California flatheaded borer (R.O. responsibility).

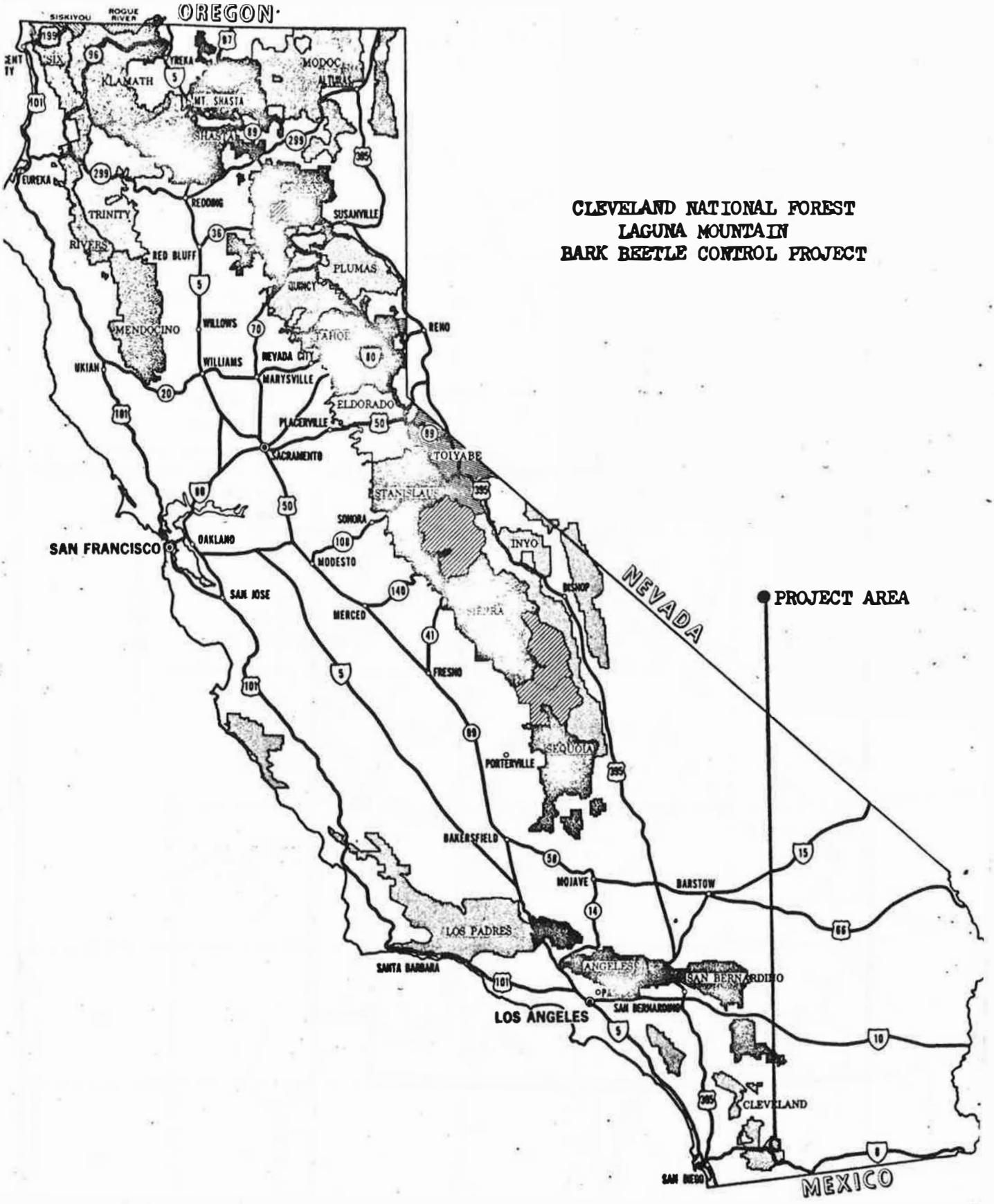

Figure 1. Descanso District, Cleveland National Forest

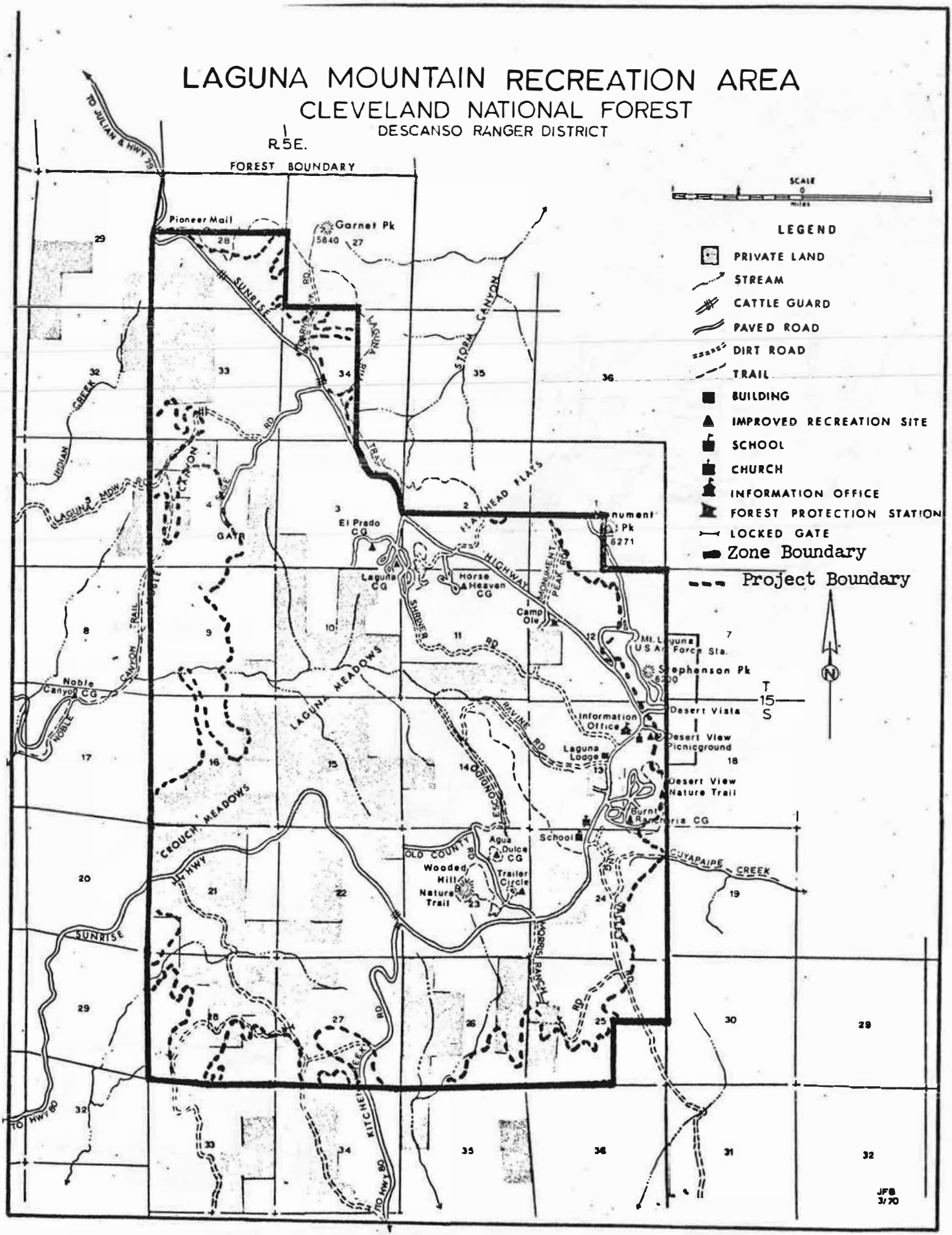

Figure 2. Julian-Cuyamaca Zone of Infestation (Laguna Mtn. Project)